Use of a Small Intestine Submucosa Extracellular Matrix Patch in Repeated Carotid Endarterectomy

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Various patches have been described in the literature for patients undergoing carotid endarterectomy. In the present report, the authors present the case of a 71-year-old woman who had bilateral carotid endarterectomies 17 years earlier and greater than 80% restenosis of the right internal carotid artery. The patient underwent a repeated right carotid endarterectomy using a small intestine submucosa extracellular matrix patch for closure of the arteriotomy. Given the unique biologic properties of the small intestine submucosa patch and the technical advantages associated with its use for patch angioplasty, further studies to define its efficacy are warranted.

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arotid endarterectomy (CEA) first gained attention in 1954.1 Since that time, CEA has evolved to become the standard of care for the prevention of embolic strokes. With the evolution of CEA, it has been demonstrated that patch closure of arteriotomy is associated with fewer perioperative complications and higher patency rates than primary closure,2-4 particularly in female patients.5 Patch materials, including the jugular vein, the greater saphenous vein, Dacron, polytetrafluoroethylene, and bovine pericardium, have been compared in the literature, with no statistically significant differences noted in terms of stroke-free survival and other important long-term end points.5,6 However, to our knowledge there have been no studies to date that assess the use of an extracellular matrix (ECM) patch for CEA. In the present article, we report a successful outcome of CEA performed using an ECM patch for arteriotomy closure. We also discuss the relevant biologic properties of ECM.

Report of Case
A 71-year-old woman presented to the clinic for biannual carotid duplex ultrasonography. Her medical history included cerebrovascular disease, congestive heart failure, chronic obstructive pulmonary disease, hypertension, and skin infections resulting from methicillin-resistant Staphylococcus aureus (MRSA). Her surgical history included bilateral CEA performed 17 years before presentation and repeated endarterectomy of the left carotid artery performed 2 years before presentation. The results of ultrasonography revealed greater than 80% stenosis of the right internal carotid artery. The results of neurologic examination indicated that she was asymptomatic.

The patient was scheduled for elective repeated endarterectomy of the right carotid artery performed with intraoperative electroencephalographic monitoring. Dissection and exposure were carried out in a standard fashion and revealed a synthetic patch from her previous CEA and a heavily calcified vessel. An arteriotomy was performed and the endarterectomy completed without the need for a shunt. A patch angioplasty was performed using an ECM carotid patch (CorMatrix) with a 6-0 polypropylene suture. No hemostatic agents or drains were used, and the operation was a technical success. The patient was discharged from the hospital on postoperative day 1. Serial duplex ultrasonography images obtained thereafter revealed a widely patent internal carotid artery.

Discussion
With patch closure being the standard of care for patients with CEA, consideration must be given to the type of patch that will be used. Although the preference of the surgeon has an obvious role in this decision, other properties should also be considered to ensure adequate long-term results. The biologic properties of ECM and its potential inherent mechanical and biologic advantages over other types of patches should be understood.

Small intestine submucosa (SIS) has been the most extensively studied ECM patch material.9 The composi-
The biologic properties of the ECM patch make the use of this material a valid alternative.\(^\text{16}\) As seen in our patient’s surgical history, restenosis is a major challenge when considering the long-term outcome of CEA. Several studies assessing restenosis in patients who have undergone peripheral bypasses have demonstrated that mechanical factors, including material mismatch and compliance mismatch, are associated with decreased short- and long-term patencies.\(^\text{17}\) Moreover, the lack of a confluent endothelium associated with synthetic materials is also involved in thrombus formation, embolism, and occlusion.\(^\text{12}\) Comparison of various bypass materials has demonstrated that the physical properties of SIS more closely resemble those of the native arteries than vein or synthetic grafts, thereby minimizing these discrepancies.\(^\text{18}\) Although no similar studies to our knowledge have compared the mechanical properties of carotid patch materials, a more thorough understanding may help predict long-term rates of restenosis and yield insight into the mechanical factors associated with adverse neurologic events after CEA.

Technical considerations must also be taken into account when choosing a patch material. In our experience, the handling properties of the ECM patch were similar to those of the autogenous vein patch. The hemostatic properties of the ECM patch are another of its desirable qualities. No hemostatic agents have been required by any of our patients who have undergone CEAs using the ECM patch. The potential cost savings resulting from not using such agents may offset the difference in price between the ECM patch (which is more expensive) and other available patches.

Conclusion

The ideal carotid patch material has yet to be identified. Perioperative complications, ease of handling, economic factors, and long-term outcomes must all be taken into account when assessing such materials. We believe that an ECM patch may offer an attractive alternative to tra-
ditional patches given its biocompatibility, resistance to infection, hemostatic properties, and ease of handling. In our patient with a history of MRSA infection who underwent repeated CEA, the ECM patch offered a good technical outcome. Long-term studies are warranted to determine the efficacy of an ECM patch compared with other available options.

References


